DOCUMENT RESUME

ED 081 381 HE 004 564

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TITLE	Cost Analysis in Higher Education.
INSTITUTION	California Univ., Berkeley. Ford Foundation Program for Research in Univ. Administration.
SPONS AGENCY	Ford Foundation, New York, N.Y.
REPORT NO	Pap-P-33
PUB DATE	Jul 72
NOTE	41p.
AVAILABLE FROM	Ford Foundation, 2288 Fulton Street, Berkeley, California 94720
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Costs; *Educational Economics; *Educational Finance; *Educational Planning; *Higher Education; Management; Program Planning

ABSTRACT

Cost analysis is of interest for: its operating and management uses within each institution; its help in providing critical inputs for planning; making major changes in capacity, program structure, or institutional policies; its uses in obtaining comparisons between institutions which help in sharing insights about what targets to set for ourselves; and its valid basis in justifying to funding sources (public and private) what prices we charge for educational and institutional services. These different uses of cost analysis are discussed briefly. The author then discusses four important cost measurement issues: (1) what resources are being absorbed? (2) how does resources use vary with changes in the volume of activity? (3) is the pattern of resource use efficient? and (4) what is the trend over time? Illustrative examples of cost measures are included in the discussion, as are comments on the problems involved in attempting cost measurement. The paper concludes with a review of management strategies designed to cope with situations of financial stress. A 20-item bibliography is included. (Author)

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ED 081381

COST ANALYSIS IN HIGHER EDUCATION

F. E. Balderston

Paper P-33

July, 1972

PREFACE

This is one of a continuing series of reports of the Ford Foundation sponsored Research Program in University Administration at the University of California, Berkeley. The guiding purpose of this Program is to undertake quantitative research which will assist university administrators and other individuals seriously concerned with the management of university systems both to understand the basic functions of their complex systems and to utilize effectively the tools of modern management in the allocation of educational resources.

Many of the studies sponsored in the Program contribute new models and techniques for cost analysis. The Program has also supported a number of empirical studies in which cost aspects were important.

The author prepared this report as a paper for presentation to the Annual Meeting of the National Association of College and University Business Officers, held in Denver, Colorado, July 9-11, 1972. The report therefore includes a survey of cost concepts and provides illustrations of the available recent evidence of cost magnitudes and trends in higher education. Its main focus is on the uses of cost analysis for institutional management.

The author gratefully acknowledges the research assistance of Constance Holton in the preparation of this report. Loren Furtado, George Turner, and Frank Schmidtlein provided helpful comments on a draft of the report, but the author is solely responsible for its content.

PART I: WHY BOTHER ABOUT COSTS?

In higher education, is it worse to know the cost of everything and the value of nothing, or the cost of nothing and the value of everything? One might almost say that in the tradition of our colleges and universities, it was the task of academic leadership to be concerned about the ideals, missions and values of the enterprise, to the exclusion of concern about costs except as an unfortunate inhibition; and it fell to the "business management" to account for the funds used and keep the framework going, without intruding into the questions of mission and value.

Now there is a joining of these two domains of responsibility, and we must talk about cost analysis in view of what is to be decided and what it is that our institutions are trying to accomplish.

Colleges and universities do vary tremendously in mission, style, size and character of organization. Thus, we will have to be cautious in generalizing about what patterns exist and what are "best concepts" for cost analysis and for institutional decision.

Our patterns of cost in higher education are an issue for government, both for institutional budgeting by the states and under existing policies and standards for Federal support in categorical programs--as well as for overhead reimbursement on Federally-funded research. There continue to be, as there have long been, arguments about how many dollars. And these arguments have intensified with the increasingly tough competition among governmental programs, such as welfare, health, conservation, and education at all levels.

At the other end of it, there is of course great interest on the part of students, their parents, and their spouses in the costs of

attending institutions of higher learning.

I shall not direct attention in this paper, however, to the issues of cost at either the aggregative, national level or the level of the individual student, although there is much that could be said about both. My focus here will be on the various aspects of cost analysis for the individual institution. (Many of the findings here can, in any case, later be adapted to examination of cost issues for government and for the student.)

Jellema, Bowen, Jenny, Cheit, O'Neill--these are not the names of battles in the War of the Roses but of our most recent chroniclers of the cost patterns and the cost-income squeeze in U.S. higher education. I made some contribution to the examination of this issue in a paper for the American Council on Education last October under the rather morbid title, "Varieties of Financial Crisis," There is no doubt that costs are a pressing issue for the here and now, and almost certainly an issue that will become more difficult for most of higher education before the situation can possibly stabilize.

Besides our need for clarity in the here and now, we can all contribute to an expanding body of knowledge for the long-term future of our institutions and of higher education. There is a growing professional consciousness among both academic and business administrators, a greater sense of the interdependences that must be understood and dealt with in more sophisticated ways than were sufficient for the past, and willingness to buy management expertise--if there is some--or magic, if there is not!

Cost analysis is of interest to us for:

- its operating and management uses, within each institution;
- its help in providing critical inputs for planning, making major changes in capacity, program structure, or institutional policies;

- its use in obtaining comparisons between institutions, which help us to share insights about what targets to set for ourselves;
- its valid basis in justifying to funding sources (public and private) what prices we charge for educational and institutional services and what resources are needed for what purposes.

Some comments are in order concerning each of these uses of cost analysis.

Operating and Management Uses of Cost Analysis

We all have to make, and live by, budgets for the institution as a whole (or even a whole multi-campus or multi-institutional system with a single budget), and for numerous types and levels of programs and operating units within the institution. Cost analysis is essential for constructing and controlling these budgets. It is needed to monitor what is happening to each budgeted activity in view of changes that inevitably occur in the workload level of the activity, and in view of effects from the environment: increases (or only too rarely, decreases) in the prices of things purchased, and increases, decreases, or changes in the composition of demands for educational and institutional services.

Costs are often a factor in day-to-day decisions. Institutions are generally of a sufficient level of complexity to require that we have written operating policies in many areas; and when a change in one of these policies is contemplated, cost analysis is usually employed to determine various aspects of the proposed change and to predict various of its consequences.

David Humphrey, of the Office of Educational Development at SUNY, wrote in the January 31, 1972 issue of The Chronicle of Higher Education:

> ". . . we have not explored the possibilities for reallocation of our resources in more cost-effective ways. . . Improvements are possible in program management to determine the efficiency of

> activities in relation to their cost. Instead of automatically decreasing services in response to 'budget cuts,' we should be capable of rearranging and reallocating our resources to allow for continuation of the services in the face of decreasing budgets . . . "

Whether Humphrey's prognosis will turn out to be correct we do not yet know, but it is clear that both political and institutional forces will constrain budgeted expenditures while maintaining the pressures for increased student enrollment. Powerful incentives will exist for rationalizing activities and making them more efficient as well as for pruning away costly operations that cannot easily be defended.

The structure of incentives within institutions is another part of the problem. We know that budgetary rules intended to recapture unused resources can actually operate perversely, causing managers to be sure they spend all they have in order not to have money taken away at the end of the fiscal period, and to avoid cuts in the previous level of budget. We also know that there are sharp differences in the style of operation of organizational units that can be regarded as performance centers as against those which simply face an open-ended "service obligation." Cost analysis, coupled with attention to the design of the structure of authority and organization, may make it possible to release incentives toward increasingly efficient management of particular activities.

Cost Analysis and Planning

Costs and cost predictions are an important aspect, though of course they are not the whole story, in developing plans and designing planning models. Cost-effectiveness and "trade-off" studies can assist considerably in the review and reworking of institutional commitments and priorities. George Weathersby and I recently completed a three-part article for the

international journal, Higher Education. There we reviewed the aspirations for PPBS in higher education, evaluated the experience with PPBS and related techniques at the University of California and gave examples of cost-effectiveness models for "policy analysis."

There are numerous examples of planning and decision issues for which cost concepts and measures that are appropriate to each situation are important.

When new buildings and other facilities are planned, it is as important to analyze the initial costs and the stream of future operating, debt service, and maintenance costs as it is to obtain good architectural and engineering design. Some institutions did not look ahead when they went through substantial building programs, and they found themselves strapped for operating funds to meet the on-going requirements of maintenance and operation of their expanded plants.

Facilities planning over long future horizons also may compel the study of patterns of future growth in enrollment and programs and the examination of usage rates and standards for accommodating such growth. A recent example of model development for this purpose, including the review of facilities utilization and the interactions between capital costs and operating costs is the "CCHE-FAM" model which was developed for the California Coordinating Council for Higher Education by Mathematica Corporation, with the involvement of staff groups of the Council and of member institutions.

New academic programs are often proposed in colleges and universities with the assertion--if the proposing department or school is very eager for the program to be accepted--that the new program will be mounted within existing resources. It will "not cost anything." University presidents and their planning staffs have learned to be skeptical of such

assertions. Normally, in fact, a new doctoral program or a new professional school or a new experimental undergraduate college needs a nucleus investment for the initial phases in order to make it possible to open the doors. Then it will induce further costs for related departments, for the library and computer center, and for the administrative structure of the institution. And as the new program grows, it may take a long or a short time to reach a size of enrollment and faculty and a depth of resources that will enable it to be academically and fiscally viable for the long pull.

If they can be secured, or even guessed at with some shrewdness, the estimates of nucleus costs, transition costs, and steady-state annual program costs need to be in hand when the decision is pending--in other words, when the information can have some effective influence.

Many colleges and universities are now reviewing possibilities for part-time degree and "extended university" programs. These entail identifying a new educational clientele and adjusting the institution's mission to meet the new need. Such new possibilities require not only close study of the size and character of the educational program that may be needed but also of costs, sources of funding, and mode of organization.

There is much talk of new educational technologies and new patterns of organization of instruction, and there is even a certain amount of actual initiation of such new approaches. Sometimes these proposals are put forward with the stated intention of saving money. It takes careful and costly design effort, involving cooperation between academic people and those who know the new technologies, to put coherent proposals together. The analysis of their initial costs and future patterns of operating costs entails special hazards because the realization of the technological and

educational design is a developmental problem in itself. And the cost per student or per unit of service can be estimated only if there are reliable forecasts of the future volume of activity.

Systems of higher education face issues of planning whether and when to add whole new campuses. During the decade of euphoric expansionism from roughly 1955 to 1965, particularly, many state systems laid out large designs for future growth. Robert Sanderson developed a technically new kind of analytical model for this type of long-horizon planning. Also, in Part III of the Weathersby-Balderston article, there is a summary of cost comparisons between year-round operations and alternative ways of accommodating enrollment.

On the side of business and administrative structure, many of us have sought to overhaul and modernize our systems. Cost analysis is important in this context when an opportunity for cost reduction or efficiency improvement can be identified. This was my experience as Vice President--Business and Finance in the University of California, when a planned purchasing system was installed to capitalize on the University's purchasing power in procurement. The new system was designed to operate through designation of existing campus-level purchasing agents to be responsible for negotiating master contracts in various areas, within the terms of which individual orders would be placed. The savings have been very substantial; and there were very minimal administrative costs or dislocations because the existing offices could be utilized.

Other new administrative systems require cost analysis to demonstrate their feasibility and desirability. Nearly every campus around the United States has seen the advent of computerized accounting. Many are on the way toward increasingly complex information systems, which may or may not

reduce the cost of administrative routines but which are quite definitely intended to increase the amount, quality and timeliness of information for academic and administrative management.

Cost Comparisons Between Institutions

If any figures are available, it is inevitable that they will be cited and used for good arguments or bad ones, for good purposes or bad, and regardless of whether or not the numbers are trustworthy. Institutions gather and share information on costs per student year and on unit costs of various programs and activities, and such figures are frequently reported to or generated by the state and Federal people concerned with higher education. Institutions like to get cost information, first of all, in order to have some basis for knowing whether they ought to be proud or worried--some sort of comparative standard. This may be especially important because typical efficiency signals of the market type are not directly available, as they are to industrial corporations which can compare their prices and profits with those of other firms in the same industry. Second, an institution may be able to direct attention to areas of operation that show significantly higher costs than are being reported by other more or less comparable institutions--higher education institutions, like other social enterprises, find they can learn from one another.

The National Center for Higher Education Management Systems of WICHE has now moved pretty well through pilot testing of the Resource Requirements Prediction Model, which has emerged from earlier efforts to design cost-tracing simulation models at the University of California and elsewhere. One of the stated purposes of the RRPM development is to have common classification schemes and data definitions so that institutions

can generate cost figures concerning various aspects of their operations and share them in meaningful ways.

Cost Justification

"Cost justification" always sounds self-serving, and sometimes indeed it is--but where would the world be without advocacy! As a practical matter, a college president or dean or administrative vice president may very much need to show that there is a good cost basis for a decision, as compared with the alternative courses of action that were rejected. And, indeed, there is often good discipline in assembling the cost justifications for decisions--unless the concepts are jumbled or the figures simply trumped up, and it is only the unwary administrator who underestimates his critics who will do that today.

External constituencies--state or Federal funding agencies, foundations, alumni and other donor groups--have increasing appetites for cost and efficiency information, and so do institutional boards of governance and various internal groups within the college or university.

Many, many institutions must now, in addition to all the other cost analyses, go through the annual rite of overhead costing to establish the case for indirect cost recovery, a ritual dance whose steps have been described in such excruciating detail by Bulletin A-21. Now there is a preliminary edition of Cost-Finding Principles and Procedures, a study and task force report by NCHEMS/WICHE. Some real advances in the concepts for cost determination may be on the way toward general adoption.

Within institutions, some activities are set up as "self-funding" cost centers, obtaining their income by making either accounting or cash charges for the services they render to various campus users. These

centers have to establish their recharge prices, and cost is usually the basis they use. The problems of setting these prices and treating the managerial responsibilities coherently are of real interest to the cause of efficient management. Certainly it is essential to have careful review of both the cost basis of such prices and the institutional impact of the recharge, self-funding concept in each such case.

Finally, cost analysis--particularly a demonstration of a rising trend--provides the most plausible justification for raising tuition and student fees. Inflationary trends in educational costs and the evidence about them are discussed in Part II, below.

PART II: PROBLEMS OF MEASUREMENT

Now we have seen the wide variety of reasons for interest in costs. When it comes to measurement, we can borrow some approaches from the extensive background of empirical, practically-informed cost studies in the business world and from the analytical contributions in econometrics and management science. In fact, one might almost turn the issue upside down and ask why cost analysis has been such a baffling problem in our colleges and universities!

There are four important cost measurement issues:

- what resources are being absorbed?
- how does resource use vary with changes in the volume of activity?
- is the pattern of resource use efficient?
- what is the trend over time?

As I discuss each of these, I shall give a few illustrative examples of cost measures and also comment on the problems that have plagued us in attempting cost measurement.

Measurement of Resources Absorbed

The accounting systems of higher education institutions are rooted in the tradition of fund accounting for financial stewardship, to which are joined a classification of the departmental or organizational units within the institution and a classification of expenditure categories.

The first problem of measuring resources absorbed, then, is to determine the appropriate boundary for the resource absorption process and find out whether the data available from the system of accounts are in a form

consistent with that boundary. These difficulties are at a minimum when the cost measurement is confined to institutionally-admitted costs for conventional units of organization, e.g., "the English Department" or "the General Library."

Cost measurement immediately becomes a much greater problem if a different kind of question is asked, such as: "what did it cost the institution to have in attendance all of its upper-division English majors last year?" To answer this question requires an analysis of the absorption of direct instructional resources by English majors both in the English department and in other departments of instruction (via such devices as an Induced Course Load Matrix of the kind used in RRPM). It also requires a look at English majors' usage of other pooled resources, such as the Library, the administrative and student services offices, the financial aid office, etc.

There are startling variations in the average annual allocated cost per student by type of major or program, as well as differences by level of student. Until some cost tracing is done, those responsible in the institution may not even be aware of the enormous magnitude of these differences. We have generally been aware of the systematically lower institutional cost per lower division student than the cost per student at the graduate level, but it has not been clear until recently that the graduate cost per student year in some fields of engineering and the laboratory sciences was as much as ten times the per-student year cost in some social science and humanities fields. Furthermore, the yearly average cost of engineering undergraduates is higher than the cost of graduate students in many areas of the humanities. Some of these differences in unit cost are due to the much greater volume of student flow into some

fields and to the necessity for a base investment in a given field if it is to be of reasonable strength. But other differences are due to the budgetary standards that have become built into college and university operations—traceable, in good part, to the large facilities and equipment overheads which have been justified in some fields on the ground that the work of the field cannot be effectively pursued without them. In any case, it is sobering to look at such large differentials in cost per student year, when the workload basis of public institutions' budgeting normally does not take into account the distribution of students by type of program, and when, in private institutions, the tuition and fees per student are not significantly different from one field to another.

Even for the tracing of current levels of resource absorption in an activity which is easily identified via the accounting structure of the institution, recorded expenditures are an incomplete measure of that activity's directly traceable costs. Our accounting systems record outlays, and those accounting systems which are on an accrual basis also permit the recording of liens and the spreading of an outlay over the relevant future periods. But recorded current expenditure rates do not give adequate measures of "true" cost for many purposes, and here are some of the reasons:

- Many institutional operations have both joint costs and joint outputs, so that to identify the cost level of a given activity may require a (partially arbitrary) allocation of joint cost pools over several activities and allocation of a departmental unit's total imputed costs over the functions it performs or the outputs it delivers.
- Our institutions are accustomed to absorbing volunteered resources which do not enter the accounting system and do not get recorded as costs. An example is the teaching time spent by voluntary clinical faculty members of medical schools.

- Our tradition in the area of capital accounting is not to do depreciation accounting for buildings, equipment, and major maintenance and renovation, so that we spend a fair amount of time being surprised about mysteriously rising costs of current building and equipment maintenance, and many institutions face periodic "emergency" pressures for replacement of a computer or other capital item for which replacement reserves have not been planned.
- Many implicit costs and opportunity costs go unnoticed because decision-makers are preoccupied with a narrower boundary of their responsibility than is really sensible.

Student time is generally considered a free good in institutional planning and operation. Thus, we underestimate our ineffectiveness (and the frustration we impose on students) when we do not take account of the time spent in waiting lines for simple bureaucratic services, the delay costs in waiting for library books that are misplaced or not recalled or not in the collection or not present in sufficient numbers of copies for the usage load. And, focussing as we normally do on what it costs the institution to operate, we do not usually think of the student's foregone opportunities and earnings as a significant cost factor in higher education; yet the estimates I have seen indicate that these foregone earnings are a major contribution of the student to his education and are a very real part of the social cost of higher education.[1]

Even within the pure business side of institutional management, we have been slow to control cash requirements and recover maximum interest earnings and investment yield on financial assets. We typically do not

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[1] See T.W. Schultz, "Resources for Higher Education - An Economist's View" in M.D. Orwig, Ed., Financing Higher Education: Alternatives for the Federal Government (Iowa City, Iowa, The American College Testing Program, 1971). Schultz asserts that earnings foregone by students are " . . . well over half of the real costs of the human capital formation by higher education." Page 20.

charge ourselves for working capital employed or account for the differential usage of working capital by operating units that are slow to settle accounts.

The above examples of implicit and opportunity costs convey the impression that if we were able to look clearly, the true costs of many institutional activities are very much understated by our traditional practices of cost analysis. On the other side, we should also look for implicit revenues and benefits that we deliver up to society as a whole, to the surrounding community, or--within the institution--the delivery of unrecorded value from one part of the institution to another. We have reason to be interested in this wherever a change is contemplated or a significant opportunity for spelling out what is really accomplished arises. In most colleges and universities, as an example, there is significant time spent by faculty members in administrative duties, not only for internal administration of departmental affairs but, often, in assisting with myriad tasks of keeping the institution going. A man-hour of faculty time, from this stand-point, also tends to be regarded as having a zero cost to the institution, and committees are appointed with gleeful abandon by deans, presidents and athletic directors (not to mention the committees brought into life by other faculty committees!).

There is good reason for caution toward proposals to tighten up and eliminate the essential types of institutional involvement by both faculty and students which do absorb energy but which help to bind the institution together. At the same time we should take thought to the uncontrolled proliferation of demands upon people's time, and we must be wary of proposals that assume--as some current proposals for increasing the classroom teaching assignments of faculty do--that the reallocations would occur at no cost to the institution.

Cost Variations with the Volume of Activity

As we have seen, it is something of an achievement simply to put cost magnitudes into the proper buckets. But there are wide classes of managerial decisions for which the relevant question is: how much will costs vary with volume? Some examples are:

- If it is decided to hold a summer session at the college, how much will this add to the total annual cost of building maintenance and utilities?
- If ten additional students, beyond the expected "norm" of twenty-five, enroll in English 103, will this add to teaching costs in the English Department, and will it reduce them anywhere else?
- If the target size of the entering freshmen class in the School of Engineering is increased permanently by one hundred students, how much will this increase expected institutional costs in the first year, the second year, the third year, etc.?
- If a new program is initiated for part-time adult students, how much will this increase the workload in the Registrar's office?

In these simple examples, the pertinent measures of volume or usage vary from case to case. The summer session will require, say, sixty days of regular in-term maintenance attention for the buildings that are used, as against the shut-down summer level. The ten extra students in English 103 may add no costs at all, or may add some work for an instructor's assistant, depending on the staffing policy; but where will the enrollees come from, and will any costs be eliminated because one or more other courses have to be cancelled, or will all other courses still be offered and staffed without any cost changes?

The permanent increase in Engineering's freshman class size will increase costs everywhere in the institution, but its full effects on teaching

costs, year by year, depend on: (a) how many entering engineering students stay as engineers, transfer to other programs within the institution, or flunk out or withdraw entirely, year by year; and (b) the distribution of the first year, second year, etc. students over courses in engineering, in physical science, in humanities, etc. (For this purpose, the induced course-load matrix is often employed.)

More generally, we can measure different aspects of the instructional volume of an institution or a program by using as the measures the following quite different quantity indicators:

- Head-count students, or those who have educational exposure and are bodies present in the institution at some time during a year;
- Student credit hours, derived by multiplying the enrollment in each course by the number of semester or quarter credits each enrolled student earns in the course;
- FTE student enrollment per year, obtained by adjusting total head-count enrollment for the extent of "part-timeness";
- Number of degrees granted, a measure of net certification output; and
- "Value-added," which means taking, for each student, a measure of his or her learning state at the start of a program, a measure at the end of it, and estimating the amount of improvement.

Each of these quantity indicators may need to be measured separately according to type of program or discipline and by the level of degree. In some institutions and state systems, there has then been an effort to construct a consolidated quantity measure by weighting the number of head-count or FTE students at each degree level by some weighting factor to give approximate reflection of the differing instructional burdens of the various levels of student; for example, lower division students might have a weight of unity, upper division undergraduates, 1.5, first-stage graduate students,

2.5, and second-stage graduate students, 3.5. The weighted FTE enrollment approach has been used to justify workload budget requests, but there is a degree of circular reasoning in using it for cost analysis, because the weights themselves are intended to reflect approximate cost differentials.

For some analyses of cost variations, one measure may be inherently better than another. Many student services, for example, vary in their usage according to the number of headcount students and not according to full-time equivalency, whereas direct teaching resources are geared to FTE enrollment. But the choices between volume measures sometimes depend on what policy attitude the decision maker has. Some believe that resource allocation should be evaluated according to the amount of institutional exposure it delivers, and for this purpose, cost per headcount student is a good measure. Others want a measure corrected for full-time equivalency because they are more strictly interested in the volume of instructional exposure. Still others, believing that net certification output is all-important and that uncompleted academic programs are worthless to the student or to society, want to see cost per degree granted, which means eliminating from the volume count all students who do not persist to the degree.

Value-added is the most sophisticated of these measures and has been the least used.

It is also desirable to keep track of the number of visitors to the college Information Center, the number of books checked out of the library, or the number of general-ledger transactions per month in the accounting system. These are typical measures of the level of activity for various intermediate services or functions, and the costs of these intermediate services tend to vary with changes in these volume indicators, not with

changes of more general institutional volume-rates such as enrollment.

If these are some of the volume indicators that need to be used for various purposes, we can ask next what is the evidence about the way costs vary with volume changes.

Here are some activities whose costs rise less than proportionately with increase of volume and whose cost per unit therefore falls:

- Unit costs fall as enrollment in a particular course rises, subject only to the availability of classroom facilities (the mode of course organization does have to shift with the addition of instructional assistants and other aids to instruction at high levels of enrollment).
- The unit cost of a kilowatt hour generated or a computer computation made is reduced at high average levels of volume because the basic equipment investment is characterized by economies of scale.
- We have found that the general administration budget on a campus can be held to a declining percentage of the total campus budget for the larger, as against the smaller, campuses of the University of California.

Unit costs may of course increase with increases in the volume of activity. Familiar causes, in industrial plants, are the saturation of available plant capacity and the necessity to pay premium overtime to the work force at high levels of output. Similarly, this can happen when excessive enrollment is piled into an academic institution or in various sub-units, but the first evidence of saturation is likely to be a higher level of delay, frustration and compromise in filling the program needs of students, while the dollar expenditures per student may actually continue to fall.

Less obvious, but more interesting analytically, are the kinds of activities whose unit costs increase for reasons of technology or organization when volume increases. Very large library collections require

extensive search of the existing collection and its records in connection with book acquisition and processing, and the staff also searches for unusual and rare items to add to the already large, specialized collections. The unit cost of acquisition and processing (apart from the actual purchase price of each new book) therefore may be higher in large libraries than in small ones.

Administrative costs for security also may increase more than proportionately with increases in campus size, partly because police duties must be handled in a more impersonal and professional way at the largest campuses, and partly because the big campus is like a big city--it has low social cohesion and, as a result of size alone, special problems of controlling mass behavior.

Measurement of Efficient Cost

The cost estimates we generally make are much cruder than the cost curves we remember from the economics textbook. The economist's short-run average cost curve for one product is drawn by assuming that it is known how to find the least-cost way of producing each possible level of output, and then connecting the points. This, of course, assumes much more than we usually know about cost behavior in higher education. When we trace down a cost magnitude, we get a unit-cost figure at one particular level of output, which is all that can be observed for a recent time period; to get another point, we have to go to the historical record for some other time period when the output rate was different, or we have to get a cost estimate from some other institution that is more or less comparable in other respects but operates at a different output level. And then, if we connect the two points, we do not necessarily have a segment of the

economist's short-run average cost curve. Why not? Because he assumes that with a fixed and known technology and a complete menu of input prices, it has already been decided how to get the best input combination for each level of output; but our cost observations are simply snapshots of the on-going situation, and we cannot assume that anything has been optimized in the management of each activity. In fact, our cost investigations are often made with a view to discovering how to do better.

We have two kinds of evidence that recorded cost experience is often far away from the efficient frontier. Plots of cost per student year, for each general type and quality of institution, show some institutions with much higher unit costs than others at the same level of enrollment. Another kind of evidence comes from Radner and Miller,[2] who studied the variations in student/faculty ratios (faculty being one major cost component). Strictly speaking, this is an input ratio rather than a cost measure, because the salaries of faculty are not included. But here, too, the student/faculty ratios varied widely for each type of institution, even after corrections were made for the percentage of graduate enrollment to total enrollment.

Part of the observed range of variations can be explained by institutional policy commitments to comfortable size or to "quality," and part may be explained by differences in disciplinary composition of programs and by the presence of programs that are high in resource cost because they are in transition. Radner, however, has sought to derive indications of the efficient frontier of student/faculty ratios. In a doctoral dissertation

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[2]Radner, R. and L.S. Miller, "Demand and Supply in U.S. Higher Education: A Progress Report," American Economic Review, May 1970, pp. 328-329.

project now under way at the University of California, Berkeley, Daryl Carlson is utilizing nationwide data for estimation of efficient-frontier input-output ratios for a number of variables.

Two other approaches to the measurement of efficient cost deserve mention. Large-scale simulation models of the WICHE-RRPM type can be used to estimate what the consequences of growth and program shifts might be, provided that the estimated structure (the set of estimated coefficients) remains stable over the range of possible changes. Professor Richard Judy of the University of Toronto and his colleagues at SRG have developed the CAMPUS model in various forms, the purpose of which is to throw light on possible efficiency improvements in an institution.

Finally, Howard Bowen and Gordon Douglass have made interesting use of the idea of putting together constructed cost functions from simple building-blocks, to explore the effects of course proliferation, class-size, and mode of instruction. Their study, Efficiency in Liberal Education, was published last year for the Carnegie Commission on Higher Education.

Measurement of Cost Trend

In The Turning Point, Jenny and Wynn find that for forty-eight private liberal arts colleges, the annual compound rate of growth in total expense per FTE student year was 6.8% from 1960 to 1970. They found that the compound rate for the period 1960-68 was 6.4%, implying considerable cost acceleration toward the end of the decade. Total income per student grew at the rate of 6.4% for the decade and 6.3% for 1960-68, showing a widening gap or cost-income squeeze.[3]

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[3]Jenny, Hans H. and G. Richard Wynn, The Turning Point, A Study of Income and Expenditure Growth and Distribution of 48 Private Four-Year Liberal Arts Colleges, 1960-70, The College of Wooster, Wooster, Ohio, 1972, Table E, p. 11.

The number of institutions covered in this study is large enough to convey a clear message about the cost problems of one major type of institution.

Cheit's New Depression covered a few private four-year colleges and examined trends in the other types of institutions, public and private. Forty-one institutions, in all, were interviewed in detail, and their data on broad categories of cost and income were assembled and analyzed. From this, Cheit made the judgment that twelve of the forty-one institutions in his survey group were "not in financial trouble," eighteen were "headed for financial trouble," and eleven were "in financial difficulty." Cheit examined components of the income pattern and the expenditure pattern of his surveyed institutions to find likely causes of financial pressure. For the institutions in financial difficulty, these cost factors were: general inflation, faculty salary increases, student aid increases, rising expenses of dealing with campus disturbance, and certain cost rises associated with growing institutional responsibilities and aspirations. Cheit also found that the "squeeze" was accounted for by lags in the growth of income to offset these rising costs.

In "Varieties of Financial Crisis," I reported the finding that administrative and subfaculty wage rates for various types of jobs had risen in the University of California at a higher compound annual rate from 1950-70 than faculty salaries. Thus, an institution with a higher-than-average proportion of non-faculty staff positions would tend to find its salary costs rising faster.[4] For the future, this phenomenon is likely to be reinforced by the increasingly easy supply of faculty talent relative to other types of personnel.

Unit prices of library materials increased at compound annual rates

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[4] Balderston, F.E., "The Varieties of Financial Crisis," American Council on Education, October 1971, Washington, D.C., pp. 13-16. Ford Foundation Program for Research in University Administration, Paper P-29, University of California, Berkeley, 1972, p. 29.

ranging from 5.3% for library books, to 6.4% for serial services, from the base period of 1957-59 to 1969. Inflationary pressure apparently intensified between 1969 and 1970, for which the periodicals index rose by 12% and a combined index of serials services rose by 8.4%. The available data also showed that, both for books and for periodicals and serials, there were significant differences between one field and another in the rate of price rise, with science and technology publications outpacing the rest.

General wholesale commodity prices rose much more slowly during the 1960's--about one-half of one percent per year for rubber and plastic products to 2.2% per year for general-purpose machinery and equipment. Construction costs rose rapidly, and accelerated to about a 12% annual rate of price increase toward the end of the decade. This, of course, implied a high rate of cost increase for maintenance and renovation contracts as well as for new construction.

The exposure of each institution to these increasing cost trends depends, of course, not only on what is happening to unit prices but on how much of each type of resource input an institution is using and on whether the composition of its resource usage is shifting toward, or away from, these kinds of resources whose costs are increasing the most rapidly. I reported in the paper cited above good illustrative evidence of differential rates of growth in various types of inputs.

In one important cost category--student financial aid--both Cheit and Jenny and Wynn find rapid acceleration in expenditures. This indicates how very important institutions feel it is to encourage access to them by financially needy students, and it also has significant bearing upon the current debates over new Federal policies of grant and loan assistance to students.

June O'Neill's valuable Carnegie Commission study, Resource Use in Higher Education: Trends in Output and Inputs, 1930-67, gives estimates of the long-term changes in cost per student credit-hour, both in current dollars for each year and with correction for trends in input prices. Not adjusting for changes in the mix of student credit-hours produced by level (graduate, upper division, lower division) she found that the current-dollar cost per credit-hour rose by 3.4% per year, compounded, from 1930-67. When input price trends were removed, this fell to 0.3% per year. Further adjustments to deal with the change in mix by using cost-based weights for the different levels of instruction cut the compound rate of increase still further to 0.1% per year.[5]

The O'Neill study is required reading for all of us. She observes that the quality content of instructional output may well have changed over this long interval, but that, aside from the adjustments for student credit-hours by level, it is not possible to make specific corrections for quality changes. Still, we are left with the impression that the real productivity of instruction in higher education may have been constant or slightly declining over a long historical period. In the face of general increases in output per man-hour in other sectors of the American economy, this implies that higher education has to make increasing relative claims for society's resources for what it produces.

Mrs. O'Neill was able to make only rough adjustments in her study for the usage of higher education resources to produce outputs other than instruction. This entanglement of input usage is a characteristic problem in cost analysis, and it means that there must remain some doubt about the

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[5] O'Neill, J., Resource Use in Higher Education, Carnegie Commission on Higher Education, Berkeley, 1971, Table 21, p. 37.

interpretation of many of our findings.

Trends in instructional costs will remain difficult to analyze until we have a better understanding of the cost interactions between instructional, research, and other activities. Even within the domain of instruction, the costing of particular programs is a vexing problem because of interdependencies between programs in the flow of students and in the reliance of several instructional areas upon joint resources. Thomas J. Walsh and the present author contributed a comment to Minerva concerning the pattern of expenditures and budgets for sponsored (or as some say, organized) research.[6] In this, we updated UC Berkeley data reported by Betz and Kruytbosch and commented on the problems of interpreting how much resource use is induced by the presence of sponsored research on a campus. Walsh is now working toward completion of a doctoral dissertation concerning sponsored research and the important problems of jointness and overhead costing that it entails.

We now leave the topic of cost measurement, with the concluding observation that it should be done in all institutions with a weather eye to the problems of joint resources, cost interaction among programs, and joint contributions to the objectives of the institution.

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[6]Balderston, F.E. and Thomas Walsh, Comment in Minerva, Vol. IX, No. 3, July 1971.

PART III: COST ANALYSIS AND MANAGEMENT STRATEGIES

Many commentators are pressing the issue of resource constraint. Virginia Smith contributed a paper "More for Less: Higher Education's New Priority" to the American Council on Education meeting last Fall to which I reported on "Varieties of Financial Crisis," James F. Nickerson reviewed some of the same themes in "Learning to Live on Less: the State College" a paper delivered to the American Association of Higher Education National Conference in March, 1972. An important forthcoming report of the Carnegie Commission is entitled Effective Use of Resources. The prognosis is that cost control and cost reduction will be an important theme of college and university administration throughout the 1970's--and, unless significant new constituencies for the services we provide can be found, as Nickerson proposes we do by redesigning and redirecting our institutions, the 1980's may make Cheit's New Depression look like a church picnic.

Whether there were severe external pressures or not, we should be interested in efficiency. Colleges and universities are not organized, however, in such a way as to prosper under no-growth, cost-cutting stresses. The largely collegial mode of obtaining consensus is traditional, in addition to which several new constituencies--student groups, women's organizations, craft unions, and faculty organizations for collective bargaining--are making their way, sometimes with the assistance of legislated mandates, to the management table. In these difficult circumstances, it will not be surprising if the first aim of institutional management is to find a strategy simply to survive.

Cost Reduction Versus Cost Shifting

When the college or university has sharply constrained resources to meet its institutional commitments, administrators can and will try to find ways to shift some costs elsewhere. An example comes to mind in the financing of student health services. In the older institutions, these were started at a time when few families had health insurance coverage. Yet students get sick, and the institution, *in loco parentis*, needed at least to have an infirmary and a nursing staff. Now the conception of what is good practice in student health care delivery has widened, and many colleges (except for those with an essentially commuting, part-time population) find that their student health services are substantial enterprises. Meanwhile, as dependent members of families, many students have health insurance entitlements, yet the method of organization of student health services may not permit insurance carriers to be billed for care that is within the entitlement of parents' health insurance. Thus, some colleges and universities have sought to update their administration of this service to shift (quite legitimately) part of what had been their costs to the health insurance carriers.

Many forms of cost-shifting onto the shoulders of students will no doubt have to be considered. Some will involve increasing the fees and charges that students pay. Others will reduce the variety of program offerings available to students, or force them to wait longer for books they need, or otherwise inconvenience them. These are all predictable administrative responses to budgetary stringency, but two things about them should be kept in mind:

- They involve no real efficiency gains; and
- They may evoke responses which, by some measures of educational

effectiveness are so negative as to cast doubt on the wisdom of the cost-shifting tactic.

One interesting form of cost-shifting has achieved increasing vogue because it runs in parallel with many student incentives for real-world involvement and freedom of educational experience. This is the "field-work interval" or the "term not in residence" for which the student arranges travel, paid work, or public service, writes a self-evaluation report or does field research, and receives credit toward the degree. Seemingly, everybody is better off: the student gets relevance, the institution collects its fees and yet does not deliver as much service as before, and can even replace the students who are away with other fee-payers. Parents can tell easily enough, though, that some mysterious cost-shifting has taken place!

The essence of cost-shifting is that the total costs of operation have not been reduced, but simply that the institution is cutting its burdens and others are assuming them.

Cost Reduction Versus Greater Effectiveness in Resource Use

Some cost reductions flow from reorganizations, effective usage of less expensive inputs relative to more expensive ones, or achievement of more efficient scale of programs. All of these kinds of cost reductions can be sought within the existing technologies of instruction and administration.

Budgetary pressure can be a useful stimulant to some of these cost reductions. Almost every institution has previously unexamined pockets of activity whose performance can be improved. Hidden costs and hidden subsidies to many operations can go unquestioned for years as part of the

budgetary base. Budgetary pressure increases the incentive to find and correct these inefficiencies.

On the side of academic organization, Bowen and Douglass point out very usefully how costs are increased by course proliferation as well as being raised or lowered by the mode of instruction that is chosen for each course.

Meritorious concern about educational quality can be aroused by efforts to limit the span of course offerings or require a relatively inexpensive mode of instruction entailing large class size and the use of discussion sections with teaching assistants. Curriculum does need to be responsive to new knowledge or to new ways of putting focus to a subject, and to prevent all new course development would be to deny the opportunity for modernization. But, as we know, course proliferation is the despair of department chairmen, budget officers, and provosts: courses can always be added, but how difficult it is to drop one!

Rising academic aspiration is one of the spurs to educational quality, but it is also a hazard to cost control. College and university faculty groups have powerful professional incentives to move to the offering of graduate programs and if possible, to initiate doctoral programs, unless they are mandated not to by restraints upon the institutional mission. It is at the point of decision on such program expansion that the most careful attention to the pay-off, relative to the costs, is essential for the long-term health of the institution.

One would think that no criterion of academic quality would require program growth in every possible direction; yet, as we are aware, the mechanisms for selective attention to some areas and for self-denial in the rest are at best weak in many institutions. State coordinating

bodies, boards of trustees, administrative leadership, and responsible faculty involvement, all appear necessary as sources of counsel toward restraint against program proliferation. If selective priority cannot be enforced, then the consequence of resource constraint is fiscal anemia in all parts of an institution.

In Less Time, More Options, the Carnegie Commission has suggested acceleration of instruction as another dimension of possible cost reduction for higher education as a whole. The thesis is that no magic attends the four-year baccalaureate degree or the indeterminately long graduate program, and that judicious use of advanced standing credits, credit by examination, and regular check-points on the student's progress can reduce the required time to completion of a degree program, thereby reducing his opportunity cost and his cash outlays for an education. It can also enable each institution to increase the number of students for whom it provides an education with its existing facilities and faculty. Carnegie Commission estimates indicate savings over-all. But the effect on each individual institution depends on how much the resource input can be reduced for each student who completes its programs, and also on the income consequences.

Many types of cost reduction can be brought about at some reduction in the standards of educational quality, elusive as that concept is. One aspect of instructional quality is the discovery of appropriate and different ways to meet the differing educational needs of students--yet standardization of course offering in each field impedes this even as it cuts costs. A research library can fall behind in maintaining its coverage of new titles in the knowledge explosion that is taking place: cash outlays are reduced, but so is the usefulness of the library for instruction and research based on the most recent contributions to the literature in each field.

Another, and highly current, issue is labor productivity, and particularly faculty productivity. If each faculty member will teach "just one more course," as a state governor has put it, more students can be provided an education with the same faculty, or the number of faculty for a given enrollment can be reduced. Legislatures in a number of states have attempted to mandate increases in faculty teaching assignments.

These pressures are based not only on the desire to conserve public funds, but also on the conviction that university and college faculties ought to put higher priority on conventionally defined teaching responsibilities and less on their research and scholarly interests.

While I was Vice President--Planning and Analysis of the University of California, my office designed and carried out a major interview survey of faculty effort and output. We sought to obtain a better understanding of the disposition of the faculty resource as between instructional, research and other activities--and equally important, the contribution that each kind and amount of activity made to the major missions of the University. In the judgment of many faculty respondents, much of their activity had joint effects, contributing to instructional, research and public service objectives and to various combinations of these.

Student/faculty ratios have increased over time in all kinds of institutions, as the Radner-Miller study shows. Whether further increases would have the cost-reducing effects that some public spokesmen claim, and what might be the penalties in quality of education available to students, are matters on which it is difficult to make sound judgments. It does appear that the range over which student/faculty ratios could increase without serious problems is not at all great for some types of institutions, unless their missions are to be significantly truncated. Radner and I estimated

from U.S. Office of Education data that the 1967 average ratios of FTE students to FTE faculty were: 21.64 for public two-year colleges; 14.54 for private four-year colleges; 17.86 for public four-year colleges, 11.26 for private universities; and 16.64 for public universities.[7] These average ratios may well have risen since 1967 in some or all sectors.

Some output per man-hour increases can be expected from increases in the amount of capital equipment used, as wage rates rise and capital is partially substituted for labor. Academic institutions have been able to borrow from the administrative technologies to advance the productivity of administrative personnel: using electric and tape-controlled typewriters, and doing accounting, payroll computation, and check issuance by computer.

Although the amount of capital resources for instruction is by no means negligible, it is not clear that capital-for-labor substitution is as yet producing cost reductions in the direct instructional process. So far, for example, there has been an accelerating appetite for computer time for instruction, but no systematic, offsetting decreases have been promised in other areas of instructional expenditure.

Some of the most striking productivity gains in the advanced societies have come from changes in the technology of industrial processes, not merely from capital deepening. There continue to be claims and hopes for similar pay-offs to new technology in higher education, but we are not putting in the large developmental investments that would be necessary to assure success--no one institution can afford them, and the Federal financing of R&D in this area is still small. The irony of it may well

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[7] Balderston, F.E. and R. Radner, "Academic Demand for New Ph.D.'s, 1970-90: Its Sensitivity to Atlernative Policies," Ford Foundation Program for Research in University Administration, Paper P-26, University of California, Berkeley, 1971, p. 19.

be that by the time new technological answers can be found, toward the end of the 1970's, we are likely to enter a considerable period of stagnant or declining enrollment. TV networks, computer-learning packages, and other technological alternatives may arrive just in time to redouble the pressures for budgetary retrenchment of the staff cadres, faculty and non-faculty, or our colleges and universities!

Joining Academic and Administrative Capabilities

This is a time, then, when all parties at interest in each college and university--students, faculty, staff, and supporting constituencies--can properly claim concern for costs and a demand to participate in the examination of how to get better results from the resources at our disposal.

We have seen that cost analysis is not irrelevant to faculty or students, as the behind-the-scenes efforts of college accountants and cost analysts once made it seem to be. And it is no less true that administrative sophistication is needed to deal with the impact of cost control on all aspects of an institution, academic as well as business management performance.

We are beginning to develop a new breed of analytically-trained person who can operate with some grace at the crossing points between the academic and the administrative sides of our institutions. There is a considerable way still to go, both in developing the techniques of cost analysis and in finding ways to weave into the pattern of decision the systematic judgments of educational effectiveness that are needed from the teachers and scholars in each discipline and profession. Many institutions face a severe risk on this score: traditionally, change in any organization is most easily lubricated with additional resources and a margin of growth, and many

colleges and universities will not have either in the 1970's, much less the '80's. Although budgetary pressure is a useful goad to some forms of cost reduction, it is also a signal for resistance to any proposal that would mean the loss of a precious piece of the budgetary pie. This is why we need informed leadership from both the administrators and the faculty. And, remembering that what students actually learn is what it is all about, we must be doubly careful in this area of academic change to find new approaches to the management of institutional resources that will actually enhance the prospects for learning.

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